in Chinese.

These results indicated that urinary 1-OHPG, 2-naphthol and urinary MDA can be used as a biomarker of environmental particulate air pollution containing PAHs. And, urinary 1-OHPG levels, 2-naphthol and MDA were related with drinking water.

ISEE-161

BIOMONITORING OF HUMAN EXPOSURE TO POLYCYCLIC AROMATIC HYDROCARBONS AND DIESEL EXHAUST BY MEASUREMENT OF URINARY BIOMARKERS

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Abstract: Polycyclic aromatic hydrocarbons (PAHs) are a class of pollutants that exist ubiquitously in the environment and are formed during incomplete combustion processes of organic materials, such as coal, gasoline, oil, wood, and cigarette. Among many sources, diesel exhaust contains not only PAHs, but also considerable amounts of nitro-PAHs that are potentially more carcinogenic and mutagenic. 1-Nitropyrene and 3-nitrobenzanthrone have been isolated from diesel fumes, and have been suggested as good markers for diesel exhaust exposure. Humans can be exposed to PAHs and nitro-PAHs through inhalation, ingestion, or dermal contact from a wide spectrum of combustion products. Epidemiological data have shown that exposure to PAHs is potentially carcinogenic to humans, as exemplified by elevated cancer incidences in certain occupations such as coke oven workers.

Human exposure to environmental PAHs and nitro-PAHs can be assessed through biomonitoring levels of their urinary metabolites, i.e., hydroxy-PAHs and amino-PAHs. An automated urinary assay that simultaneously measures 23 OH-PAHs, including metabolites of benzo[a]pyrene, has been developed in our laboratory at the Centers for Disease Control and Prevention (CDC). This method is being expanded to measure diesel biomarkers and other 11 amino-PAHs in human urine. The methodology includes enzymatic hydrolysis, automated solid phase extraction, derivatization, and final analysis by gas chromatography - high resolution mass spectrometry (GC-HRMS). The method is robust, precise, and highly reproducible. Limit of detection for most OH-PAHs are in low part-per-trillion level.

The measurement of urinary PAH metabolites allows the assessment of an individual's internal dose of PAHs, and provides epidemiologists and health scientists with unique information to evaluate health effect associated with PAH exposure. This method will be applied for the analysis of samples from the National Health and Nutrition Examination Survey (NHANES), performed by CDC annually to assess exposure of general U.S. population to these environmental pollutants, as well as other case-control studies.

ISEE-162

URINARY PAH METABOLITES AND OXIDATIVE STRESS BIOMARKERS FOR THE ASIAN DUST EVENTS

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Introduction: Asian Dust Events (ADEs) are the dust storm originated from Mongolia and China, which can also get to the West Coast of USA. The ADEs were reported to be associated with increased daily mortality in Seoul, Korea from previous epidemiological studies. This study evaluated the potential usefulness of urinary 1-hydroxypyrene glucuronide (1-OHPG) and 2-naphthol as environmental aromatic hydrocarbons (PAHs), 8-hydroxy-deoxyguanosine (8-OHdG) and malondialdehyde (MDA) as oxidative stress markers related to the ADE.

Materials and Methods: Urine samples were collected from 224 subjects (112 children and 112 their mothers) from Seoul (n=60), Inchon (n=104) and Pohang (n=60) twice before and after the ADE (April 13, 2003). Urinary 1-OHPG levels were measured by synchronous fluorescence spectroscopy after immuno-affinity purification using monoclonal antibody 8E11. Urinary 2-naphthol levels were measured by HPLC with fluorescence detector. Levels of urinary 8-OHdG were measured by using ELISA and levels of urinary MDA by HPLC with UV detector.

Results: Levels of urinary 1-OHPG and 2-naphthol after the ADE were higher than those before the ADE, which were not significant. Levels of urinary 8-OHdG after the ADE (7.76 ± 2.57 ng/ml) were higher than those before the ADE (2.45 ± 4.4) (n=30 paired, $p<0.05$). Levels of urinary MDA after the ADE (0.44 ± 1.82 umol/L) were higher than those before the ADE (0.38 ± 2.0) (n=60 paired, $p<0.1$). There were a significant correlation between levels of urinary 1-OHPG and 8-OHdG both after (n=78, r=0.44, $p<0.001$) and before the ADE (n=78, r=0.42, $p<0.001$). Urinary 1-OHPG and MDA levels were correlated with after ADE (n=178, r=0.22, $p<0.01$) and before ADE (n=178, r=0.17, $p<0.05$). Urinary MDA and 2-naphthol levels were also correlated with after ADE (n=176, r=0.29, $p<0.01$) and before ADE (n=176, r=0.24, $p<0.01$).

Conclusions: Although the ADEs were very mild in this year than previous years, our findings suggest that urinary 8-OHdG and MDA levels increased after the ADE and these biomarkers could be used as useful biomarkers for the ADE.

ISEE-163

A CORRELATION STUDY OF ORGANOCHLORINE LEVELS IN SERUM, BREAST ADIPOSE AND GLUTEAL ADIPOSE TISSUE AMONG BREAST CANCER CASES IN INDIA

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Background: In order to investigate the relationships between organochlorine levels across different biological media, we utilized measurements in serum, breast adipose and gluteal adipose tissue from breast cancer patients enrolled in a pilot study carried out in Kerala, India in 1997. Our objective was to determine whether serum is a reliable biomarker of lifetime body burden of organochlorines compounds. This was a unique population to study, with respect to organochlorine compounds, since some (DDT and β-BHC) were still commonly used in India until recently for malaria control, while others (PCBs) are not so abundant in Kerala.

Methods: Biological samples were collected from 37 untreated breast cancer patients, who were fasting at time of sample collection. Gas-liquid chromatography was used to determine serum, breast adipose and gluteal adipose tissue levels of organochlorines. Summary statistics (mean, median, geometric mean), Spearman correlation coefficients (r) and ratios of the summary statistics were calculated for both crude and lipid-corrected values of DDT, DDE, β-BHC, and one highly chlorinated PCB congener, PCB-180.

Results: Levels of DDT (medianserum =97.4 ng/g lipid) and its metabolite, DDE (medianserum =619.4 ng/g lipid), were high, compared with levels reported throughout the literature; levels of β-BHC (medianserum =2,818.2 ng/g lipid) were orders of magnitude higher; PCB-180 concentrations (medianserum =5.07 ng/g lipid) were the lowest reported. There were strong correlations between serum, breast adipose and gluteal adipose tissue concentrations for all organochlorines measured, ranging from r=0.65 to 0.95. For each summary statistic, ratios were close to 1:1 for most of the comparisons between lipid-corrected serum, breast adipose, and gluteal adipose samples.

Discussion: To our knowledge, this is the first study to investigate the correlations and ratios of organochlorines levels measured across three biological media. The strong correlations between biological media did not depend on the timing of exposure, since DDT and β-BHC exposures were likely recent, DDE reflects older exposures to DDT, and PCB exposure in this population was likely ambient, nor did they depend on whether exposures were high or low. We concluded that measurements in blood serum reflect lifetime body burden to the extent that breast and gluteal adipose tissue do. This is important to confirm, since it is much less invasive to collect a blood sample than an adipose tissue sample.

ISEE-164

CURRENTLY THE DEPARTMENT OF DEFENSE (DOD) DOES NOT USE EXPOSURE BIOMARKERS TO MEASURE SERVICE MEMBERS EXPOSURE TO ENVIRONMENTAL CHEMICALS

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Abstract: Currently the Department of Defense (DoD) does not use exposure biomarkers to measure Service Members exposure to environmental chemicals. Blood and urine exposure biomarkers for volatile organic compounds (VOC), selected heavy metals, depleted uranium (DU), and chemical warfare agents are currently available but have not been field tested or validated in military deployments as a tool to document exposures by the DoD. The Military Deployment Human Exposure Assessment Study, a prospective cohort of 46 soldiers deployed to Bosnia, was designed to field test blood and urine exposure biomarkers as a mechanism to document exposures to these chemicals during military deployments. Blood and urine were collected pre-, during, and post deployment. Standard questionnaire, environmental and occupational monitoring methods were conducted for comparison to the exposure biomarker results. This paper compares and describes the pre-, during, and post deployment blood VOC results, compares these to standard US blood VOC levels, reports deployment environmental and occupational measurements, and attempts to correlate environmental with blood VOC results. The study outcomes indicate that exposure biomarkers may be valuable tools to the DoD in exposures and risks from environmental and occupational chemicals.

ISEE-165

ENVIRONMENTAL EXPOSURES AND OTHER CHARACTERISTICS ASSOCIATED WITH DETECTABLE PAH-DNA ADDUCTS AMONG A POPULATION-BASED SAMPLE OF HEALTHY WOMEN

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Introduction: The presence of polycyclic aromatic hydrocarbon (PAH)-DNA adducts in human lymphocytes may be useful as a surrogate endpoint for individual cancer risk prediction. In this study, we examine the relationship between environmental sources of PAH and other parameters on the presence of PAH-DNA adducts in a large population-based sample of healthy women.

Methods: Adult women over 20 years of age were randomly identified from the general population between August 1996 and July 1997. Among the 1,556 women who completed a structured questionnaire, 941 donated sufficient blood (25+ ml) to allow use of a competitive ELISA for analysis of PAH-DNA adducts in peripheral blood mononuclear cells. Recent ambient PAH levels were estimated using geographic modeling (n=796). Environmental home samples of dust (n=220) and soil (n=197) were colleted on a subset of long-term residents (15+ years). A predictive multiple logistic regression was fit to estimate odds ratios for detectable levels of PAH-DNA adducts (n=648) compared with non-detectable PAH-DNA adducts (n=293). Backward selection was used to identify environmental measures or other characteristics that appreciably contributed to the model. Three separate models were constructed based on data from the: (A) questionnaire, including a dietary history; (B) environmental home samples; and (C) geographic modeling.

Results: Season of blood donation and active cigarette smoking were strongly associated with detectable PAH-DNA adducts. Compared with other seasons, women who donated blood in summer had over a two-fold increased odds of detectable adducts (OR=2.65, 95% CI=1.69, 4.17). Current and past smokers had a 50% and 46% increased odds of detectable adducts, respectively. There were inconsistent associations between detectable adducts and other known sources of PAH such as grilled and smoked foods, or a summary measure of total dietary benzo-a-pyrene (BaP) intake during the year prior to the interview. Other factors associated with detectable adducts included increased age, increased income, age at menarche, and fewer months of breastfeeding. Detectable adducts were inversely associated with increased BaP levels in dust, but positively associated with BaP levels in soil although confidence intervals were wide. Ambient BaP estimates were not associated with dectectable adducts.

Discussion: These data suggest that PAH-DNA adducts detected among a population-based sample of adult women with ambient exposure levels reflect some key PAH exposure sources assessed in this study, such as cigarette smoking, but not all.

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